Heights of rivers above zeros of gauges—Continued.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Black River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Kingstree, S. C.	60	12	7.4	2	1.2	22-28	3.3	6.2
Lumber River.								
Fairbluff, N. C.	10	6	2.5	1	— 0.4	15-19	0.1	2.9
Lynch Creek.								
Effingham, S. C.	35	12	4.3	28	2.2	18	2.9	2.1
Potomac River.								
Harpers Ferry, W. Va.	170	16	0.7	1	0.0	7-19; 21-24	0.2	0.7
Roanoke River.								
Clarksville, Va.	155	12	0.4	27	— 0.4	13-17, 21	—0.1	0.8
Sacramento River.								
Redbluff, Cal.	241	23	0.7	2	0.0	18-30	0.1	0.7
Sacramento, Cal.	70	25	8.7	1-11	8.3	26-30	8.5	0.4
Santee River.								
St. Stephens, S. C.	50	12	5.1	27	— 1.4	18-22	1.0	6.5
Congaree River.								
Columbia, S. C.	37	15	2.0	23, 24	1.5	1-22; 25-30	1.5	0.5

Heights of rivers above zeros of gauges—Continued.

Stations.	Distance to mouth of river.	Danger-line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Wateree River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Camden, S. C.	45	24	5.0	1	1.7	18, 19	2.6	3.3
Savannah River.								
Augusta, Ga.	130	33	12.5	24	4.2	16, 18	5.7	8.3
Susquehanna River.								
Wilkesbarre, Pa.	178	14	1.0	28, 29	— 1.0	4-26	—0.7	2.0
Harrisburg, Pa.	70	17	2.2	29	0.5	15	1.0	1.7
Juniata River.								
Huntingdon, Pa.	80	24	3.8	24	2.8	1-23, 30	2.9	1.0
W. Br. of Susquehanna.								
Williamsport, Pa.	35	20	2.4	25	0.0	11, 12	0.7	2.4
Waccamaw River.								
Conway, S. C.	40	7	2.4	4	0.9	18	1.5	1.5

*Distance to Gulf of Mexico.

SPECIAL CONTRIBUTIONS.

THE HIGHEST KITE ASCENSIONS AT BLUE HILL.

By S. P. FERGUSSON (dated October 20, 1897).

On September 19, 1897, the kite meteorograph was raised to a height of 2,821 meters (9,255 feet) above the summit of the Hill, or 3,013 meters (9,885 feet) above sea level. The highest kite was 40 meters (131 feet) above the meteorograph, or 3,052 meters (10,016 feet) above sea level. The height reached by the meteorograph was 510 feet higher than that reached on October 8, 1896.

At the top of the line were two self-adjusting kites of the Hargrave pattern, having an area of 36 and 41 square feet. Five other kites of the same pattern, having an area of 22.9 square feet each, were respectively attached at the following distances from the top kites: 500, 1,500, 2,500, 3,500, and 5,000 meters. The length of the line employed was 6,300 meters, as shown by the register attached to the windlass. This register is made to indicate 1.5 per cent less line than is actually employed, in order to allow for sagging. The weight of the line was 59 pounds, and the pull, when 5,000 to 6,300 meters were out, varied between 104 and 152 pounds, the latter amount being about one-half of the breaking strain of the wire.

The instrument left ground at 0:01 p. m., and the highest point was reached at 4:17 p. m. At this time the angular altitude of the meteorograph (observed by means of a surveyor's transit) was 26.6°. At the windlass the angular altitude of the line was but little lower than that of the meteorograph. The work of reeling in the line began at 4:30 p. m., and the meteorograph reached the ground again at 6:40 p. m., having been in the air six hours and thirty-nine minutes, and during nearly five hours of this time, at a height of nearly 1 mile or more above sea level. There were stops of three to fifteen minutes after every 500 meters of line were let out or reeled in, and a stop of twenty minutes was made near the highest point.

The record obtained from the meteorograph is nearly complete, and is one of the smoothest that has been obtained. The record of relative humidity is incomplete at the highest point, and also a break of one hour's duration occurred in the record of height between 4 and 5 p. m. The record of temperature is complete.

The temperature at the highest point was 37.6° while at the Observatory it was 63°, the rate of fall being more rapid below the height of 2,000 meters above sea level than above it. The relative humidity rose rapidly until 700 meters was reached, then between 900 and 1,400 it fell lower than the humidity recorded at the Observatory. Between 1,450 and 1,900 meters the humidity was very high, and at 2,100 it fell again, afterward rising slightly at 2,200 meters and falling at 2,400 meters; above 2,500 meters it was very low, the trace going to 26 per cent and probably lower, the incompleteness of the record at the highest point rendering it impossible to determine the lowest reading. The wind at the ground was from the south and southwest during the entire flight, and varied in velocity from nearly 30 miles at noon to 20 miles an hour at 6 p. m. The direction of the wind gradually became westerly with increasing altitude, and above 2,000 meters it was almost exactly west.

On October 15, 1897, the meteorograph was raised to a height of 3,379 meters (11,086 feet) above the hill, or 3,571 meters (11,716 feet) above sea level. This height is 558 meters (1,831 feet) greater than that reached on September 19. The highest kite was 40 meters above the meteorograph, or 3,611 meters (11,847 feet) above sea level.

At the top of the line were a Lawson ribbed kite, having an area of 71 square feet, and an adjustable Hargrave kite, having an area of 36 square feet. Two other Hargrave kites, having an area of 22.9 square feet each, were respectively attached at distances of 2,000 and 3,500 meters from the top kites. The length of line employed was 6,300 meters, and the pull, when all the line was out, varied between 125 and 150 pounds. The instrument left ground at 3:48 p. m., and the highest point was reached at 6 p. m. The work of reeling in the line began at 6 p. m., and the instrument reached ground at 8:20 p. m.

The record obtained from the meteorograph is one of the best that has been secured, being complete, with very clear and smooth lines. (The meteorograph sheet is reproduced in facsimile as Chart VIII.)

The temperature at the highest point was 41°, and at the observatory it was 72°. An interesting feature of the flight was the passing of the meteorograph through the cumulus and alto-cumulus cloud levels, as shown by the increase, followed by decrease, of humidity at heights of 1,500 and 2,800 meters.

At the ground the wind direction was southwest during the entire flight, and the velocity varied between 13 and 22 miles an hour. Above the height of 1,000 meters the direction of the wind was northwest.

No mishap of any kind occurred during the experiments, the steam windlass reeling in the line easily and smoothly at a rate which was made to vary from 0.5 to 2.7 meters a second, according to the strain upon the line. The experiments were conducted under the direction of Mr. Rotch by Mr. Clayton, Mr. Sweetland, and the writer, and formed two of a series of high-level flights now being made with the aid of a grant of money from the Hodgkins fund held by the Smithsonian Institution.

Chart VIII. Record by Kite Meteorograph, Blue Hill Observatory, October 15, 1897.